

REMARKS

Applicants are amending their claims in order to further clarify the definition of various aspects of the present invention. Specifically, Applicants have amended claim 1 to recite that the resin with an imide structure is a polyamideimide resin, and has a structure that includes a structure represented by general formula (1) previously set forth in claim 3. In light of amendments to claim 1, claims 3-5 and 7 have been cancelled without prejudice or disclaimer, and claims 6 and 8 have been amended to further define the “polyamideimide” resin.

Moreover, new claims 17 and 18 have been added to the application. Claim 17, dependent on claim 1, recites that the polyamideimide resin contains a specified amount of a specific polyamideimide molecule. Claim 18, dependent on claim 1, recites that the fiber base material is a glass cloth having a specified thickness. In connection with claims 17 and 18, note, for example, pages 15 and 26 of Applicants' specification.

Applicants respectfully traverse the rejection of claim 3 under the second paragraph of 35 USC 112, as set forth in Item 2 on page 2 of the Office Action mailed February 6, 2008, particularly insofar as this rejection is applicable to claim 1 as presently amended (claim 1 having incorporated therein subject matter of previously considered claim 3). That is, claim 1 as presently amended recites that the resin (polyamideimide resin) has a structure that includes a structure represented by the specified general formula (1). That is, as described on pages 3 and 4 of Applicants' specification, the resin, which is a polyamideimide resin (and, accordingly, has amide and imide groups), also includes structure of the general formula (1). It is respectfully submitted that claim 1 as presently amended is sufficiently definite such that one of ordinary skill in the art would know whether any

specific resin of the prepreg fell within or outside the scope of the resin recited in the present claims. Accordingly, under the present circumstances, it is respectfully submitted that the necessary requirements of 35 USC 112, second paragraph, have been satisfied. See In re Moore, 169 USPQ 236 (CCPA 1971).

In the Office Action mailed February 6, 2008, the Examiner contends that claim 3 is indefinite "because chemical formula 1 is not an imide structure". It must be emphasized that according to presently amended claim 1, the resin is a polyamideimide resin, having amide and imide groups, and additionally has the structure represented by general formula (1). It is respectfully submitted that general formula (1) is a structure of the polyamideimide resin in addition to the structural moieties providing the polyamideimide designation of the resin. General formula (1) is not the polyamideimide structure itself, but rather is an additional structure provided in the resin. Based upon this explanation, and noting claim 1 as presently amended, reciting that the structure of the resin includes a structure represented by general formula (1), it is respectfully submitted that the present claims satisfy requirements of the second paragraph of 35 USC 112.

Applicants respectfully submit that all of the claims presented for consideration by the Examiner patentably distinguish over the teachings of the references applied by the Examiner in rejecting claims in the Office Action mailed February 6, 2008, that is, the teachings of the U.S. patents to Takeuchi, et al., No. 7,138,174, and to Mizuno, et al., No. 7,157,506, and Japanese Patent Document No. 11-335682, under the provisions of 35 USC 102 and 35 USC 103.

It is respectfully submitted that the references as applied by the Examiner would have neither disclosed nor would have suggested such a prepreg, or such a metal foil-clad laminate using such prepreg, or such printed circuit board using such

metal foil-clad laminate, as in the present claims, wherein the prepreg is obtained by impregnating a resin composition including a polyamideimide resin and thermosetting resin as in the present claims, with the polyamideimide resin having a structure that includes a structure represented by general formula (1), such resin composition being impregnated into a fiber base material with a thickness of 5-50 µm. See claim 1; note also claims 15 and 16.

Furthermore, it is respectfully submitted that the teachings of these applied references would have neither disclosed nor would have suggested such a prepreg as in the present claims, having features as discussed previously in connection with claim 1, and including, additionally, wherein the resin with an imide structure, which is a polyamideimide resin, has a siloxane structure (see claim 3); and/or further definition of the polyamideimide resin as in claims 6 and 8; and/or wherein the thermosetting resin is an epoxy resin, as in claim 9, having two or more glycidyl groups (see claim 10); and/or wherein the composition further includes a phosphorus-containing compound, in amounts thereof, as in claim 11, or further contains a hindered phenol-based or organic sulfur compound-based antioxidant as in claim 12, more specifically, is one or more types of the antioxidant compounds as set forth in claim 13; and/or combustion distance of the prepreg as in claim 14; and/or further definition of the polyamideimide resin as in claim 17; and/or further definition of the fiber base material as in claim 18.

The present invention is directed to a prepreg, and to a metal foil-clad laminate and printed circuit board employing such prepreg.

Laminates for printed circuit boards are formed by stacking a prescribed number of preps that include an electrical insulating resin composition, and subjecting the preps to heat and pressure for integration. Such laminates are

provided with a metal foil such as a copper foil on one or both surfaces of the laminate, with the foils being patterned for forming electrical circuitry.

Recently, with the trend toward miniaturization and high-densification of the printed circuit boards, and with newly proposed surface mounting methods, heat resistance of the insulating resin has become more important, with higher heat resistance being necessary. In addition, halogen-free materials are also necessary, precluding use of bromine-based flame retardants.

In addition, because it becomes necessary to repair the printed circuit boards by removing mounted chips and replacement thereof, each procedure requiring heat treatments, cycling heat shock-resistant properties at high temperatures have also become necessary.

Thus, it is desired to provide prepregs, for use in printed circuit boards, exhibiting heat shock resistance, reflow resistance and crack resistance, and improved microwiring formation properties. In addition, it is also necessary to provide printed wiring boards having dimensional stability and the ability to be bent and housed at high density in electronic device packages, the prepreg having adhesion with metal foils and fiber base materials. Note, in particular, paragraph [0008] on page 3 of Applicants' specification.

Against this background, Applicants provide a prepreg having excellent heat resistance and pliability. Applicants have found that by utilizing a resin composition, to impregnate a fiber base material, which includes a thermosetting resin and a polyamideimide resin having a structure that includes a structure of general formula (1), the fiber base material having a thickness of 5-50 μm , heat resistance and flexibility as desired can be achieved; moreover, through use of such impregnating resin composition, together with a fiber base material with a thickness of 5-50 μm , a

prepreg having good flexibility with good heat resistance including thermal cycling resistance, and other favorable properties, is achieved.

Takeuchi, et al. discloses a prepreg having adhesion properties and heat resistance, the prepreg comprising a fiber base material impregnated with a resin composition which comprises a polyamideimide resin and a thermosetting resin as essential components. See column 2, lines 59-62. Note also column 3, lines 20-25, disclosing use of a siloxane-modified polyamideimide resin. Note also disclosure of the fiber base material, in the paragraph bridging columns 9 and 10 of this patent, including disclosure that glass cloth is preferred, more preferably woven fabric comprised of glass fiber, with a thickness preferably being 10-200 µm. Note also column 10, lines 50-59, disclosing use of copper and aluminum foils.

It is respectfully submitted that Takeuchi, et al. discloses prepgs with substrate material thickness overlapping that in the present claims. It is respectfully submitted that Takeuchi, et al. would have neither taught nor would have suggested the prepreg as in the present claims, of the specified material and having a thickness of 5-50 µm, achieving with such thickness a flexibility of the prepreg as achieved by the material of the present claims.

Moreover, and contrary to the contention by the Examiner, it is respectfully submitted that Takeuchi, et al. would have neither disclosed nor would have suggested use of the polyamideimide resin in the impregnating resin composition as in the present claims, having a structure that includes a structure represented by general formula (1), and advantages thereof; and base material thickness range with impregnating resin composition, and advantages thereof.

The contention by the Examiner on page 3 of the Office Action mailed February 6, 2008, that it is disclosed in Takeuchi, et al. in column 3, that the imide

resin is preferably a siloxane-modified polyamideimide "as per instant claims 2-6", is respectfully traversed. Attention is particularly directed to previously considered claim 3, now incorporated into claim 1, setting forth a specific structure represented by the general formula (1). Upon close review of column 3 of Takeuchi, et al., general formula (1) is not seen. It is respectfully submitted that Takeuchi, et al. would have neither disclosed nor would have suggested such prepreg as in the present claims, wherein the fiber base material has been impregnated with the resin composition including the specific polyamideimide resin which includes a structure represented by general formula (1).

Contrary to the conclusion by the Examiner, it is respectfully submitted that the teachings of Takeuchi, et al. would have neither taught nor would have suggested such prepreg as in the present claims, including wherein the impregnating resin composition comprises, inter alia, the polyamideimide that includes a structure represented by general formula (1).

Furthermore, note that Takeuchi, et al. has a patenting date of November 21, 2006, after the effective filing date under 35 USC 371 for the above-identified application, i.e., March 4, 2005. The patent (No 7,138,174) only qualifies as prior art under 35 USC 102(e). Contrary to the conclusion by the Examiner, Patent No. 7,138,174 does not qualify as prior art under 35 USC 102(a), having a patenting date after the effective filing date of the above-identified application.

And, as shown previously, Takeuchi, et al. would not have disclosed the presently claimed subject matter.

In addition, the following statement is made:

The above-identified application and U.S. Patent No. 7,138,174 were, at the time the invention of the above-identified application was made, owned by Hitachi Chemical Co., Ltd.

In view of the foregoing, it is respectfully submitted that the Takeuchi, et al. patent is disqualified as prior art under 35 USC 103. Accordingly, the rejection based on the Takeuchi, et al. patent as a reference must fall in this basis alone.

However, attention is respectfully directed to United States Patent Application Publication No. 2004/0258899, published December 23, 2004, which is a prior publication of U.S. Patent No. 7,138,174. Such prior publication has a publication date prior to the effective filing date of the above-identified application. But note further that the Japanese priority applications for the above-identified application have an earlier filing date than the publication date of No. 2004/0258899. English translations of these four (4) Japanese priority application are enclosed herewith.

In any event, and as shown previously, it is respectfully submitted that U.S. Patent No. 7,138,174 is disqualified as prior art under 35 USC 103.

Furthermore, it is respectfully submitted that additional teachings of the secondary references applied by the Examiner would not have rectified the deficiencies of Takeuchi, et al., such that the presently claimed invention as a whole would have been obviousness to one of ordinary skill in the art, even were Takeuchi, et al. to qualify as prior art under 35 USC 103.

Mizuno, et al. discloses a resin composition suitable for printed-wiring boards, and a prepreg and metallic copper clad laminate produced using this resin composition. The resin composition includes, as its essential components, a cyanate compound having two or more cyanato groups in the molecule; a phenol compound; a silicone polymer having at least one siloxane unit selected from the group consisting of specified tri-functional and tetra-functional siloxane units, the at least one siloxane unit having a polymerization degree of 7,000 or less and at least one terminal functional group reactive with a hydroxyl group; and an inorganic filler.

See column 5, lines 24-35. This patent also discloses metal-clad laminates produced by drying a base material impregnated with the aforementioned resin composition, as described in column 6, lines 45-51. See also column 6, lines 52-58.

Even assuming, arguendo, that the teachings of Takeuchi, et al. and of Mizuno, et al. were properly combinable, such combined teachings would have neither disclosed nor would have suggested the presently claimed prepreg and members formed using such prepreg, including, inter alia, wherein the resin composition includes a polyamideimide resin, having a structure that includes a structure represented by the general formula (1), or thickness of the fiber base material, and advantages thereof, and/or other features of the present invention as discussed previously, and advantages thereof.

In addition, note that U.S. Patent No. 7,157,506, applied by the Examiner, has a publication date of January 2, 2007, after the effective filing date of the above-identified application. Moreover, the following statement is made:

The above-identified application and U.S. Patent No. 7,157,506 were, at the time the invention in the above-identified application was made, owned by Hitachi Chemical Co., Ltd.

In view of the foregoing, it is respectfully submitted that U.S. Patent No. 7,157,506 is disqualified as prior art under 35 USC 103; and for this reason also the prior art rejections utilizing No. 7,157,506 are clearly improper.

However, attention is respectfully directed to the publication date of PCT publication No. WO 01/70885, as well as the publication date of U.S. Patent Application Publication No. 2003/0130412, each having a publication date prior to the filing dates for the Japanese priority applications of the above-identified application. It must be emphasized that the Examiner has not applied the published PCT application or published U.S. application, as a reference in the Office Action

mailed February 6, 2008. Even if applied, and for the reasons discussed previously, it is respectfully submitted that the combined teachings of Takeuchi, et al. and of Mizuno, et al. would have neither disclosed nor would have suggested the presently claimed invention.

Japanese Patent Document No. 11-335652 discloses a film adhesive excellent in heat resistance and adhesion to inorganic materials and heat-resistant resin materials, obtained by mixing the solutions of two kinds of polyimide resins having specific structures with each other. Note the Abstract of No. 11-335652. Attention is respectfully directed to Item [2] bridging pages 1 and 2 of No. 11-335652.

It is emphasized that No. 11-335652 shows a structure within the scope of general formula (1), incorporated in a polyimide resin. It is respectfully submitted that the combined teachings of the applied Japanese patent document and Takeuchi, et al. would have neither disclosed nor would have suggested such prepreg as in the present claims, wherein the impregnating resin composition includes a polyamideimide resin which includes a structure represented by general formula (1), as in the present claims, especially impregnated into a base material having a thickness in a range set forth in the present claims, even were Takeuchi, et al. to qualify as prior art, it again being contended that the Takeuchi, et al. U.S. patent applied by the Examiner is disqualified as prior art under 35 USC 103.

In Item 7 bridging pages 4 and 5 of the Office Action mailed February 6, 2008, the Examiner notes that Takeuchi, et al. does not disclose the polyamideimide resins as required by present claim 8, but notes that the Japanese reference discloses a polyimide resin having the structure set forth in the first line on page 5 of the Office Action mailed February 6, 2008, and discloses that such polyimide resin has excellent heat resistance, and concludes therefrom that it would have been obvious

to one of ordinary skill in the art to use the polyimide resin of the Japanese reference in the Takeuchi, et al. reference "in order to have a prepreg that can withstand high temperatures". However, it must be emphasized that the Japanese reference discloses a polyimide resin, not a polyamideimide resin as in the present claims. It is respectfully submitted that the combined teachings of Takeuchi, et al. and of the Japanese reference, even were the applied Takeuchi, et al. patent to qualify as prior art under 35 USC 103, would have neither disclosed nor would have suggested the polyamideimide resin including the structure of general formula (1), as in the present claims.

In view of the foregoing comments and amendments, reconsideration and allowance of all claims presently pending in the above-identified application are respectfully requested.

To the extent necessary, Applicants hereby petition for an extension of time under 37 CFR 1.136. Kindly charge any shortage of fees due in connection with the filing of this paper, including any extension of time fees, to the Deposit Account of Antonelli, Terry, Stout & Kraus, LLP, Account No. 01-2135 (case 1303.46565X00), and please credit any overpayments to such Deposit Account.

Respectfully submitted,

ANTONELLI, TERRY, STOUT & KRAUS, LLP

By /William I. Solomon/
William I. Solomon
Registration No. 28,565

Attachments: English translations of the 4 Japanese priority documents

WIS/ksh
1300 N. 17th Street, Suite 1800
Arlington, Virginia 22209
Tel: 703-312-6600
Fax: 703-312-6666